実験報告書様式（一般利用課題・成果公開利用）

（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

CROSS TOKAI **Experimental Report** J-PARC	承認日 Date of Approval 2013/07/16 承認者 Approver Takashi Ohhara 提出日 Date of Report 2013/07/16
課題番号 2012B0147 実験課題名 Title of experiment High Magnetic Field Neutron Diffraction in Shastry-Sutherland System - Step 1 実験責任者名 Name of principal investigator Hiroyuki Nojiri 所属 Affiliation Institute for Materials Research, Tohoku University	装置責任者 Name of Instrument scientist Takashi Ohhara 装置名 Name of Instrument/（BL No.） BL18 実施日 Date of Experiment 2013/03/13-2013/03/15

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）

Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

$SrCu_2(BO_3)_2$ single crystal

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

We have made the first experiment by using a split-pair coil at BL18 to realize a high resolution-multi peak scanning neutron diffraction experiment in very high pulsed-magnetic fields. The final target of this experiment is to investigate the magnetization plateaus observed in quasi two-dimensional materials. The sample is the Shastry and Sutherland lattice and the realization is found in $SrCu_2(BO_3)_2$. The compound has a unique orthogonal arrangement of dimers in two-dimension. For the frustration between the nearest neighbor and the next-nearest neighbor interactions, the effective repulsive interaction acts among triplets. The hopping of triplets is strongly suppressed for the orthogonal dimer network. These two special conditions result in the formation of plateau state.

Figure 1 shows the TOF spectrum at room temperature used in the present experiment. A series of (a 0 0) peak is observed at room temperature and these peaks are used to estimate the intensity of magnetic peaks expected at plateau state.

Figure 2 shows the cut-view of the split-pair coil used in the present experiment. The magnet is directly cooled by liquid nitrogen and there is a free vacuum pass of neutron in the center flange. This special structure enables us to satisfy both low background and high resolution in pulsed magnet experiments.

Figure 3 shows the magnetic field intensity at the center flange as a function of charging voltage. A 25 T can be generated at 4000 V. The energy is about30 kJ.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

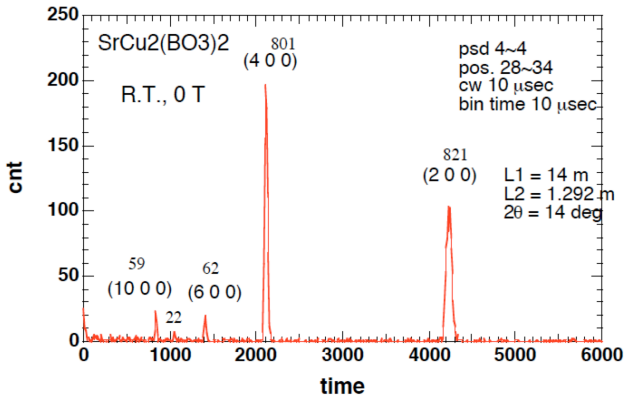

Fig.1 Example of TOF spectrum.

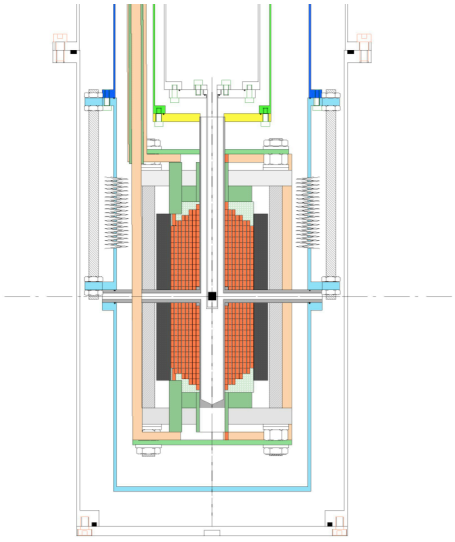

Fig.2 Cut view of split-pair coil.

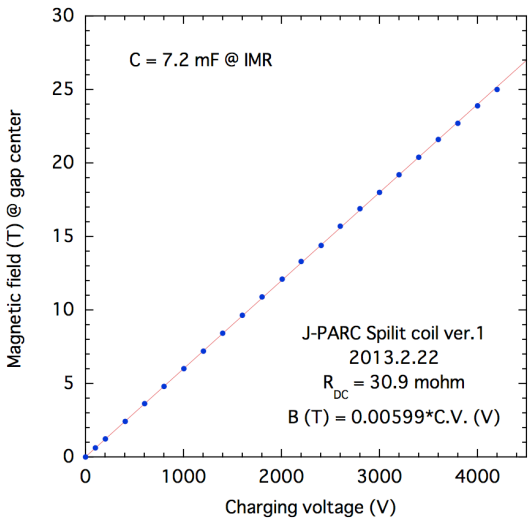

Fig. 3 Charging voltage v.s. center magnetic field intensity of a split-pair coil.

We have made a test experiment by using both a split-pair magnet and a solenoid magnet for comparison. Then we have confirmed the improvement of resolution in the split-pair magnet. We have also tested the DAC scheme in the event mode. It is found that there is a problem that the data transfer cannot be independent of the number of pulsed field generation. Namely, the data is not transferred from the DAC module till the shot number reaches to 32 shots. In the present experiment in which shot number is in 10-100 shots, this feature can be a problem. The investigation for the improvement of DAC operation is under process for next step of this experiment.